Orbigator Electronics Specification

Version 1.8

This document consolidates all electrical, mechanical, and interface specifications for the Orbigator project, including complete Pico 2 pin mapping, UI input definitions, motor driver interfaces, power notes, and a full hyperlinked Bill of Materials (BOM).

1. System Overview

The Orbigator is a dual■axis orbit visualization mechanism. It uses: - A LAN rotational axis (Pololu■driven bipolar stepper) - An Argument■of■Vehicle (AOV) stepper axis (ULN2003 + 28BYJ■48) - A user interface module integrating an OLED display, rotary encoder, encoder push, and CONFIRM/BACK buttons - A DS3231 real■time clock sharing the same I²C bus All electronics are controlled by a Raspberry Pi Pico 2.

High■Level Functional Block Diagram

Pico Pin	Signal	Subsystem
GP4	SDA	OLED + DS3231 (I2C)
GP5	SCL	OLED + DS3231 (I2C)
GP16	ENC_A	Rotary Encoder A
GP17	ENC_B	Rotary Encoder B
GP18	ENC_PUSH	Encoder Push (active LOW)
GP26	CONFIRM	UI Button (active LOW)
GP27	BACK	UI Button (active LOW)
GP8■11	AOV_IN1■4	ULN2003 #1 (AOV Stepper)
GP19■22	ULN2_IN1■4	ULN2003 #2 (Spare Stepper)
GP14	LAN_STEP	Pololu #1 STEP
GP15	LAN_DIR	Pololu #1 DIR
GP2,3	LAN_M0,M1	Pololu #1 Microstep Pins
GP0,1	M2_STEP,DIR	Pololu #2 STEP/DIR
GP6,7	M2_M0,M1	Pololu #2 Microstep Pins
GP13	POLOLU_EN	Shared EN/SLEEP

2. Pico 2 Pin Map

The following tables define all GPIO assignments for firmware and PCB layout. These match pins.py.

2.1 I²C + User Interface

Signal	Function	GPIO	Electrical
SDA	OLED + RTC data	GP4	I²C
SCL	OLED + RTC clock	GP5	I²C
ENC_A	Encoder A	GP16	Digital
ENC_B	Encoder B	GP17	Digital
ENC_PUSH	Encoder push	GP18	Active LOW (pull■up)
CONFIRM	Confirm button	GP26	Active LOW (pull■up)
BACK	Back button	GP27	Active LOW (pull■up)

2.2 ULN2003 Stepper Driver Pins

Motor	Signal	GPIO	Notes
AOV Stepper	AOV_IN1	GP8	
	AOV_IN2	GP9	
	AOV_IN3	GP10	
	AOV_IN4	GP11	
Spare	ULN2_IN1	GP19	
	ULN2_IN2	GP20	
	ULN2_IN3	GP21	
	ULN2_IN4	GP22	

2.3 Pololu DRV8834 Stepper Driver Pins

Driver	Signal	GPIO	Notes
Pololu #1 (LAN)	STEP	GP14	
	DIR	GP15	
	M0	GP2	
	M1	GP3	
Pololu #2 (Spare)	STEP	GP0	
	DIR	GP1	
	M0	GP6	

	M1	GP7	
Shared	EN/SLEEP	GP13	Shared across both drivers

3. OLED + Encoder Module

The user interface module includes an OLED, rotary encoder, encoder push button, and dedicated CONFIRM and BACK buttons.

Pin #	Signal	Function
1	CONFIRM	Confirm button (active LOW)
2	SDA	OLED I²C data
3	SCL	OLED I²C clock
4	PSH	Encoder push (active LOW)
5	TRA	Encoder A
6	TRB	Encoder B
7	BAK	Back button (active LOW)
8	GND	Ground
9	VCC	3.3–5V input

4. Real■Time Clock (DS3231)

The DS3231 module shares the I²C0 bus with the OLED. It uses SDA/SCL on GP4/GP5. Module includes onboard pull■ups; external pull■ups not required.

5. Bill of Materials (BOM)

Item	Component	Notes / Footprint	Link
1	Raspberry Pi Pico 2	2×20 DIP	https://www.raspberrypi.com/products/rasp
2	ULN2003 Boards (x2)	IN1-IN4 headers	https://www.pololu.com/product/2130
3	DRV8834 Pololu Drivers (x2)	A4988 footprint	https://www.pololu.com/product/2134
4	OLED + Encoder Module	9-pin header + mounts	https://www.crcibernetica.com/i2c-oled-disp
5	DS3231 RTC	4-pin header	https://www.adafruit.com/product/3013
6	28BYJ-48 Stepper	AOV axis	https://www.sparkfun.com/products/10551
7	NFP-GW12T-10BY Motor	LAN axis	https://www.nfp-motor.com/gw12-by-series
8	DC Barrel Jack	5.5×2.1mm	https://www.sparkfun.com/products/119
9	Pin Headers	2.54mm	https://www.sparkfun.com/products/116

6. Notes for PCB Design

- CONFIRM, BACK, and encoder push are active■LOW; use internal pull■ups. - OLED/Encoder module mounting: 60mm × 30mm, M3 holes. - Shared EN/SLEEP line on GP13 drives both Pololu drivers. - I²C bus shared cleanly by OLED and DS3231. - Pololu modules must use the standard A4988 footprint. - ULN2003 modules vary; recommended: bring signals to headers.